

What is claimed is:

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1. An apparatus comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:
 - a ridge relation obtaining unit obtaining relation of a ridge containing a vicinal feature point near a feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and
 - a matching unit performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process.
2. The apparatus according to claim 1, wherein said information about the feature point has a format comprising an identifier assigned to each feature point and corresponding feature information

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about the feature point.

3. The apparatus according to claim 1, wherein
when a number of ridges from the feature point
5 to be checked to a ridge containing the vicinal
feature point, and when feature information about
the vicinal feature points matches in a predetermined
range, it is determined that feature points to be
checked contained in the first and the second
10 fingerprints are same feature points.

4. The apparatus according to claim 1, wherein
in said first and second fingerprint, when said
feature information about the vicinal feature points
15 matches in a predetermined range, a number of ridges
between the feature point to be checked and a ridge
containing the vicinal feature point matches a value
obtained by counting a number of ridges in an opposite
direction from the feature point to be checked to
20 the vicinal feature point, and a number of ridges
between the feature point to be checked and a ridge
containing the vicinal feature point matches a value
obtained by counting a number of ridges in a direction
from the feature point to be checked to the vicinal
25 feature point, it is determined that feature points

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to be checked contained in the first and the second fingerprints are same feature points.

5. The apparatus according to claim 1, wherein
5 when said first and second fingerprints match in at least one of position, type, and direction of the vicinal feature points, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints
10 are same feature points.

6. The apparatus according to claim 1, wherein
when said feature points to be checked match in position and direction in a predetermined range,
15 but are different in type in said first and second fingerprints, a resultant matching level is low.

7. The apparatus according to claim 1, wherein
when said vicinal feature points match in
20 position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

8. The apparatus according to claim 1, wherein
25 when said feature points to be checked are

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different in type in said first and second fingerprints, a matching process is performed by changing relation between ridges containing the feature points to be checked and ridges containing the vicinal feature points.

9. An apparatus comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

a virtual feature point generation unit generating a virtual feature point by referring to the first and the second feature points;

a ridge relation obtaining unit obtaining relation of a ridge containing the virtual vicinal feature point near the feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process;

and

a matching unit performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing

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the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process.

- 5 10. The apparatus according to claim 9, wherein
said information about the virtual feature
point has a format comprising an identifier assigned
to each virtual feature point and corresponding
feature information about the virtual feature point.
- 10 11. The apparatus according to claim 9, wherein
when a number of ridges from the feature point
to be checked to a ridge containing the virtual
vicinal feature point, and when feature information
15 about the virtual vicinal feature points matches
in a predetermined range, it is determined that
feature points to be checked contained in the first
and the second fingerprints are same feature points.
- 20 12. The apparatus according to claim 9, wherein
when said first and second fingerprints match
in at least one of position, type, and direction
of the virtual vicinal feature points, it is
determined that feature information of feature
25 points to be checked contained in the first and the

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second fingerprints are same feature points.

13. The apparatus according to claim 9, wherein
when said feature points to be checked match
5 in position and direction in a predetermined range,
but are different in type in said first and second
fingerprints, a resultant matching level is low.
14. The apparatus according to claim 9, wherein
10 when said virtual vicinal feature points match
in position and direction in a predetermined range,
but are different in type in said first and second
fingerprints, a resultant matching level is low.
- 15 15. The apparatus according to claim 9, wherein
said virtual feature point is generated by
projecting an existing feature point to a vicinal
ridge.
- 20 16. The apparatus according to claim 15, wherein
feature information about the virtual feature
point is feature information about a feature point
from which a virtual feature point is projected.
- 25 17. The apparatus according to claim 9, wherein

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when said feature points to be checked are different in type in said first and second fingerprints, a matching process is performed by changing relation between ridges containing the
5 feature points to be checked and ridges containing the vicinal feature points.

18. An apparatus comparing an obtained first fingerprint with a preliminarily registered second
10 fingerprint, and determining whether or not the fingerprints match each other, comprising:

a virtual feature point generation unit generating a virtual feature point by referring to the first and the second feature points;

15 a ridge relation obtaining unit obtaining relations of a ridge containing a vicinal feature point near a feature point, and a ridge containing the virtual vicinal point to be checked in a matching process performed on the first and the second
20 fingerprints to the ridge containing the feature point to be checked in the matching process; and

a matching unit performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature
25 point to be checked in the matching process for the

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relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, and performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, thereby determining whether or not the feature point to be checked is matching.

19. The apparatus according to claim 18, wherein when said feature point to be checked matches in position and direction in said first and second fingerprints in a predetermined range, but does not match in type, evaluation of a matching result is set low.

20. The apparatus according to claim 18, wherein when said vicinal feature point or said virtual feature point matches in position and direction in a predetermined range in the first and second fingerprints, but does not match in type, evaluation

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of a matching result is set low.

21. The apparatus according to claim 20, wherein
a matching process is performed on a
5 combination of the vicinal feature point of said
first and second fingerprint and the virtual feature
point.

22. The apparatus according to claim 18, wherein
10 when said first and second fingerprints match
in feature points to be checked and said vicinal
feature points match several times for the feature
points to be checked, evaluation of a matching result
is enhanced depending on a number of matching
15 results.

23. A method for comparing an obtained first
fingerprint with a preliminarily registered second
fingerprint, and determining whether or not the
20 fingerprints match each other, comprising:

(a) obtaining relation of a ridge containing
a vicinal feature point near a feature point to be
checked in a matching process performed on the first
and the second fingerprints to the ridge containing
25 a feature point to be checked in the matching process;

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and

(b) performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process.

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24. The method according to claim 23, wherein said information about the feature point has a format comprising an identifier assigned to each feature point and corresponding feature information about the feature point.

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25. The method according to claim 23, wherein when a number of ridges from the feature point to be checked to a ridge containing the vicinal feature point, and when feature information about the vicinal feature points matches in a predetermined range, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

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26. The method according to claim 23, wherein
in said first and second fingerprint, when said
feature information about the vicinal feature points
matches in a predetermined range, a number of ridges
5 between the feature point to be checked and a ridge
containing the vicinal feature point matches a value
obtained by counting a number of ridges in an opposite
direction from the feature point to be checked to
the vicinal feature point, and a number of ridges
10 between the feature point to be checked and a ridge
containing the vicinal feature point matches a value
obtained by counting a number of ridges in a direction
from the feature point to be checked to the vicinal
feature point, it is determined that feature points
15 to be checked contained in the first and the second
fingerprints are same feature points.

27. The method according to claim 23, wherein
when said first and second fingerprints match
20 in at least one of position, type, and direction
of the vicinal feature points, it is determined that
feature information of feature points to be checked
contained in the first and the second fingerprints
are same feature points.

28. The method according to claim 23, wherein
when said feature points to be checked match
in position and direction in a predetermined range,
but are different in type in said first and second
5 fingerprints, a resultant matching level is low.

29. The apparatus according to claim 23, wherein
when said vicinal feature points match in
position and direction in a predetermined range,
10 but are different in type in said first and second
fingerprints, a resultant matching level is low.

30. The apparatus according to claim 23, wherein
when said feature points to be checked are
15 different in type in said first and second
fingerprints, a matching process is performed by
changing relation between ridges containing the
feature points to be checked and ridges containing
the vicinal feature points.

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31. A method for comparing an obtained first
fingerprint with a preliminarily registered second
fingerprint, and determining whether or not the
fingerprints match each other, comprising:

25 (a) generating a virtual feature point by

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referring to the first and the second feature points;

(b) obtaining the relation of the ridge containing a virtual vicinal feature point near the feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

(c) performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process.

32. The method according to claim 31, wherein said information about the virtual feature point has a format comprising an identifier assigned to each virtual feature point and corresponding feature information about the virtual feature point.

33. The method according to claim 31, wherein when a number of ridges from the feature point to be checked to a ridge containing the virtual

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vicinal feature point, and when feature information about the virtual vicinal feature points matches in a predetermined range, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

34. The method according to claim 31, wherein when said first and second fingerprints match in at least one of position, type, and direction of the virtual vicinal feature points, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

35. The method according to claim 31, wherein when said feature points to be checked match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

36. The method according to claim 31, wherein when said virtual vicinal feature points match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

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37. The method according to claim 31, wherein
said virtual feature point is generated by
projecting an existing feature point to a vicinal
ridge.

38. The method according to claim 37, wherein
feature information about the virtual feature
point is feature information about a feature point
from which a virtual feature point is projected.

39. The method according to claim 17, wherein
when said feature points to be checked are
different in type in said first and second
fingerprints, a matching process is performed by
changing relation between ridges containing the
feature points to be checked and ridges containing
the vicinal feature points.

40. A method for comparing an obtained first
fingerprint with a preliminarily registered second
fingerprint, and determining whether or not the
fingerprints match each other, comprising:

(a) generating a virtual feature point by
referring to the first and the second feature points;

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(b) obtaining relations of a ridge containing a vicinal feature point near the feature point, and a ridge containing a virtual vicinal point to be checked in a matching process performed on the first
5 and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

(c) performing the matching process by searching the second fingerprint containing the
10 vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching
15 process, and performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature
20 point to the ridge containing the feature point in the first feature point to be checked in the matching process, thereby determining whether or not the feature point to be checked is matching.

25 41. The method according to claim 40, wherein

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when said feature point to be checked matches in position and direction in said first and second fingerprints in a predetermined range, but does not match in type, evaluation of a matching result is set low.

42. The method according to claim 40, wherein when said vicinal feature point or said virtual feature point matches in position and direction in a predetermined range in the first and second fingerprints, but does not match in type, evaluation of a matching result is set low.

43. The method according to claim 42, wherein a matching process is performed on a combination of the vicinal feature point of said first and second fingerprint and the virtual feature point.

44. The method according to claim 40, wherein when said first and second fingerprints match in feature points to be checked and said vicinal feature points match several times for the feature points to be checked, evaluation of a matching result is enhanced depending on a number of matching

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results.

45. A computer-readable storage medium storing a program for directing a computer to realize a method
5 for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

10 (a) obtaining relation of a ridge containing a vicinal feature point near a feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing a feature point to be checked in the matching process; and

15 (b) performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point
20 to the ridge containing the feature point in the first feature point to be checked in the matching process.

46. A computer-readable storage medium storing a
25 program for directing a computer to realize a method

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for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

- 5 (a) generating a virtual feature point by referring to the first and the second feature points;
- (b) obtaining the relation of the ridge containing a virtual vicinal feature point near the feature point to be checked in a matching process
- 10 performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and
- (c) performing the matching process by searching the second fingerprint containing the
- 15 virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching
- 20 process.

47. A computer-readable storage medium storing a program for directing a computer to realize a method for comparing an obtained first fingerprint with

25 a preliminarily registered second fingerprint, and

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determining whether or not the fingerprints match each other, comprising:

(a) generating a virtual feature point by referring to the first and the second feature points;

5 (b) obtaining relations of a ridge containing a vicinal feature point near the feature point, and a ridge containing a virtual vicinal point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing
10 the feature point to be checked in the matching process; and

(c) performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked
15 in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, and performing the matching process by searching the
20 second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first
25 feature point to be checked in the matching process,

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thereby determining whether or not the feature point
to be checked is matching.

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